

ABSTRACT OF THE INVENTION

A three-dimensional, geologic basin simulator for predicting natural resource location and characteristics is disclosed. The simulator integrates seismic inversion techniques with other data to predict fracture location and characteristics. The invention's 3-D finite element basin reaction, transport, mechanical simulator includes a rock rheology that integrates continuous deformation (poroelastic/viscoplastic) with fracture, fault, gouge, and pressure solution. Mechanical processes are used to coevolve deformation with multi-phase flow, petroleum generation, mineral reactions, and heat transfer to predict the location and producibility of fracture sweetspots. The simulator uses these physico-chemical predictions to integrate well log, surface, and core data with the otherwise incomplete seismic data. The simulator delineates the effects of regional tectonics, petroleum-derived overpressure, and salt tectonics and constructs maps of high-grading zones of fracture producibility.